LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Sept. 3-6, 2013.

THE SCIENCE BEHIND A CHEMICAL ATTACK

United Nations arms experts arrive to inspect a site suspected of being hit by a deadly chemical weapons attack last week on the northeastern outskirts of Damascus, Syria. Photo by Mohamed Abdullah/AFP/Getty Images.

The deadly nerve gas Sarin is believed to be behind the poison gas attack that killed more than 1,400 people in Syria on Aug. 21. Sarin is immensely more powerful than a pesticide. A dab the size of a pea is enough to cause death, according to Pete Estacio, a physician and chemist who works with Lawrence Livermore's Forensics Science Center.

Victims have mere minutes to stay alive during a chemical weapons attack, but only if they've been immediately treated with one of a suite of antidotes that can counter the effects.

In a move to help save lives, LLNL is developing a new "smart" military uniform that could transform its structure to repel chemical agents. The carbon nanotube-based material is designed to be breathable in hot weather. When it encounters a nerve agent like Sarin or VX, polymers embedded into the fabric would rapidly react with the poison gas molecules to seal the material shut, providing instant protection. These polymers also would destroy and shed the uniform's contaminated surface layer like snakeskin.

To read more, go to PBS Newshour.

LaserFocusWorld FEEL THE HEAT

All NIF experiments are controlled and orchestrated by the integrated computer control system in the facility's control room.

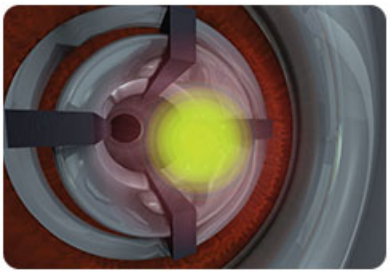
The National Ignition Facility (NIF) at Lawrence Livermore focused all 192 of its ultra-powerful laser beams on a tiny deuterium-tritium filled capsule in the early morning hours of Aug. 13. In the nanoseconds that followed, the capsule imploded and released a neutron yield of nearly 8,000 joules of neutron energy -- approximately three times NIF's previous neutron yield record for cryogenic implosions.

The primary mission of NIF is to provide experimental insight and data for the National Nuclear Security Administration's science-based stockpile stewardship program. The experiment attained conditions not observed since the days of underground nuclear weapons testing and represents an important milestone in the continuing demonstration that the stockpile can be kept safe, secure and reliable without a return to testing.

Early calculations show that fusion reactions in the hot plasma started to self-heat the burning core and enhanced the yield by nearly 50 percent, pushing close to the margins of alpha burn, where the fusion reactions dominate the process.

To read more, go to *Laser Focus World*.

Los Angeles Times ELEMENTAL DISCOVERY



The moment of collision between an accelerated calcium-48 ion and an americium-243 target atom, which went on to create element 115.

Element 115 -- which has a temporary name of ununpentium – was first created in 2003 in Russia by scientists from the Joint Institute for Nuclear Research in Dubna and collaborators from Lawrence Livermore National Laboratory. That team produced four atoms of ununpentium, which quickly lost two neutrons and decayed into element 113.

A new set of experiments backs up the discovery of 115 after an international team of physicists synthesized an element with 115 protons in the GSI accelerator in Germany.

When a new element is created, the International Union of Pure and Applied Chemistry requires that another group of researchers not related to the first discovery confirm the results by replicating its own set of experiments. This is the first step to official recognition and eventual naming of element 115.

To read more, go to the *Los Angeles Times*.

HPC wire A BOOST TO THE WORLD ECONOMY

Chief Executive John Womersley of the UK's Science and Technology Facility Council (left) and Director Parney Albright, Lawrence Livermore National Laboratory, sign a memorandum of

understanding to collaborate in applying high performance computing (HPC) to economic competitiveness.

In a collaboration symbolizing unity, the United Kingdom's Science and Technology Facilities Council (STFC) and the Lawrence Livermore National Laboratory's High Performance Computing Innovation Center (HPCIC) will collaborate to expand industry's use of supercomputing to boost economic competitiveness in the two countries.

The signed memorandum of understanding provides a vehicle for technical and business development exchanges between the HPCIC and the STFC's Hartree Centre.

Initial joint projects with the Hartree Centre will likely include the development of software tools that would allow industry to leverage Blue Gene/Q's computing power for industrial and business applications. BG/Q's architecture lends itself to data intensive computing tasks important to work in applications such as cyber-security, network optimization, atmospheric modeling, bioinformatics and medicine. Data intensive computing is commonly referred to as "big data."

To read more, go to *HPC wire*.

ScienceDaily®

NUSTAR DELIVERS THE GOODS

This artist's concept illustrates a supermassive black hole with millions to billions times the mass of our sun. Image courtesy of NASA/JPL-Caltech.

NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, is giving the wider astronomical community a first look at its unique X-ray images of the cosmos. The first batch of data from the black-hole hunting telescope recently was made publicly available.

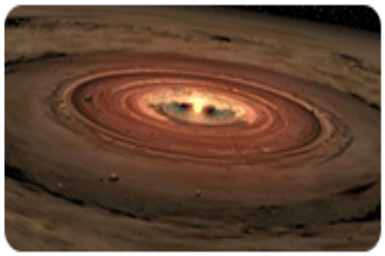
The Laboratory was involved in both the design and testing of the X-ray optics that fly on NuSTAR.

The images, taken from July to August 2012, shortly after the spacecraft launched, comprise an assortment of extreme objects, including black holes near and far. The more distant black holes are some of the most luminous objects in the universe, radiating X-rays as they consume surrounding gas. One type of black hole in the new batch of data is a blazar, which is an active, supermassive black hole pointing a jet toward Earth. Systems known as X-ray binaries, in which a compact object such as a neutron star or black hole feeds off a stellar companion, also are in the mix, along with the remnants of stellar blasts called supernovae.

To read more, go to *Science Daily*.

redOrbit
YOUR UNIVERSE ONLINE

THE DEAD ZONE



A new study shows how vortices help destabilize the disk so that gas can spiral inward toward a forming star. Image courtesy of NASA/JPL-Caltech.

A new theory by fluid dynamics experts shows how "zombie vortices" help lead to the birth of a new star.

A team led by UC Berkeley computational physicist Philip Marcus shows how variations in gas density lead to instability, which then generates the whirlpool-like vortices needed for stars to form.

The study has caught the attention of Richard Klein, adjunct professor of astronomy and a theoretical astrophysicist at Lawrence Livermore. Klein is collaborating with Marcus to put the zombie vortices through more tests.

Klein has worked over the last decade to calculate the crucial first steps of star formation, which describes the collapse of giant gas clouds into Frisbee-like disks.

"Other research teams have uncovered instabilities in protoplanetary disks, but part of the problem is that those instabilities required continual agitations," Klein said. "The nice thing about the zombie vortices is that they are self-replicating, so even if you start with just a few vortices, they can eventually cover the dead zones in the disk."

To read more, go to *Red Orbit*.
